JC690 U.S. PTO
05/23/00

JC658 U.S. PTO
09/576022
05/23/00

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventors: Erik WALLACE, et al.

Title: MOBILE ACTIVITY STATUS TRACKER

Attorney Docket No.: 20-430

PATENT APPLICATION TRANSMITTAL LETTER

Box PATENT APPLICATION
Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

Enclosed are the following papers relating to the above-named application for patent: **(1)** specification (including claims and Abstract) - 30 pages; **(2)** 14 informal sheets of drawings; **(3)** an Assignment with Cover Sheet – 7 pages; **(4)** a signed Declaration and Power of Attorney – 3 pages; and **(5)** a check in the amount of $952 for the filing fee calculated as follows:

CLAIMS AS FILED				
	NO. FILED	NO. EXTRA	RATE	CALCULATIONS
Total Claims	28 - 20 =	8	x $18 =	$144
Independent Claims	4 - 3 =	1	x $78 =	78
Multiple Dependent Claim(s), if applicable			$260 =	0
Basic Fee				690
Assignment Recordation				40
			TOTAL FEE:	$952

The Commissioner is authorized to charge any additional fees due or credit any overpayments to **Deposit Account No. 50-0687 under Order No. 20-430.** A copy of this letter is enclosed.

Please address all correspondence to **FARKAS & MANELLI, PLLC, 2000 M Street, N.W. 7th Floor, Washington, DC 20036-3307**, and all telephone calls to William H. Bollman at (202) 261-1000.

Respectfully submitted,

Date: May 23, 2000

William H. Bollman
Reg. No.: 36,457
Attorney for Applicants

Farkas & Manelli, PLLC
2000 M Street, N.W. 7th Floor
Washington, DC 20036-3307
(202) 261-1000

APPLICATION UNDER UNITED STATES PATENT LAWS

Invention: **MOBILE ACTIVITY STATUS TRACKER**

Inventor(s): Erik WALLACE;
Walter WEICHSELBAUMER;
Daniel HRONEK;
Mark TITUS; and
Dara UNG

Farkas & Manelli P.L.L.C.
2000 M Street, N.W.
Suite 700
Washington, D.C. 20036-2396
Attorneys
Telephone: (202) 261-1000

Docket: 2003-0543

This is a:

[ ] Provisional Application

[X] Regular Utility Application

[ ] Continuing Application

[ ] PCT National Phase Application

[ ] Design Application

[ ] Reissue Application

[ ] Plant Application

SPECIFICATION

MOBILE ACTIVITY STATUS TRACKER

This application is related to and claims priority from a co-pending US provisional application, serial number 60/196,104, entitled "Mobile Activity Status Tracker", and filed on April 11, 2000.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to wireless carriers, Internet service providers (ISPs), information content delivery services/providers, portal sites for mobile-terminated hosting of chat groups, and/or Internet chat session hosts. More particularly, it relates to the network perspective of mobile device functions and/or requirements such as ANSI-41 or ANSI-41C automatic registration, mobile presence, mobile location, and/or mobile availability.

2. Background of Related Art

The present invention relates to improvements to mobile wireless systems, which currently include mobility management, IS-41 mobility management, and/or registration systems, to support, e.g., Internet chat, ICQ, etc.

As is known, presence information and location information regarding a particular wireless device is recorded in a Home Location Register for the relevant wireless network.

Fig. 10 shows a conventional stand-alone Home Location Register (SHLR) architecture and message flow of a Mobile Registration Notification message (REGNOT).

In Fig. 10, a first wireless network **1060** includes a mobile switching center MSC **1010** and a stand-alone Home Location Register (SHLR) **1040**. The SHLR **1040** and the MSC **1010** communicate over the

public switched telephone network (PSTN) via one or more switching transfer points (STPs) **1030**. The protocol used for communication is IS-41 or GSM-MAP over signaling system No. 7 (SS7).

The service provider is typically given maintenance and configuration proprietary access to the database stored in the SHLR using an Operations and Maintenance Processor (OMP) and provisioning terminal console **1050**, which may communicate with the SHLR using a point-to-point link, e.g., an X.25 link, an RS-232 link, or a TCP/IP link. Communications from the OMP **1050** typically relate to maintenance and configuration only, and do not relate to operational functions of the relevant wireless network.

A second wireless network **1070** servicing another wireless device **1090** includes another MSC **1020**, and utilizes one or more STPs **1030** in the PSTN.

In the given scenario, assume that the wireless device **1090** in communication with the second wireless network **1070** is serviced by the service provider of the first wireless network **1060**. Thus, presence and location information regarding the second wireless device **1090** is stored and updated in the SHLR **1040** corresponding to its servicing network.

To communicate presence and location information to the 'home' register of the second wireless device **1090**, a MOBILE REGISTRATION message (1.) is sent in accordance with Signaling System #7 (SS7) standards using IS-41C protocol messages through the second wireless network **1070** to the MSC **1020** of the second wireless network **1070**. The 'presence' of a wireless device relates to the wireless device being powered ON and reachable in the relevant wireless network.

The MSC **1020** forwards the MOBILE REGISTRATION message (1.) upon receipt to the STP **1030** as an IS-41 REGISTRATION NOTIFICATION (REGNOT) message (2.).

The STP **1030** forwards the REGNOT message (3.) to the appropriate SHLR **1040** servicing that particular wireless device **1090**.

In this way, the Home Location Register of a particular wireless device **1040** is provided with presence and location information regarding the whereabouts and registration activity of a particular subscriber (e.g., wireless device **1090**).

Fig. 10 relates to a Home Location Register which is installed as a separate network element. Using a SHLR **1040** as shown in Fig. 10, the SHLR **1040** must communicate with the associated MSC **1010** using SS7 signaling through the STP **1030**. Presence and location information is updated in a subscriber's Home Location Register in a similar manner when the Home Location Register is integrated onto a common platform with the MSC element. This configuration is known as an integrated Home Location Register (I-HLR).

Fig. 11 shows a conventional integrated Home Location Register (I-HLR) architecture and message flow of a Mobile Registration Notification message (REGNOT) allowing proprietary communications between elements such as the MSC and I-HLR operating on a common platform.

In particular, as shown in Fig. 11, a MOBILE REGISTRATION message (1.) is sent to the MSC **1020** providing access to the roaming wireless device **1090**, and the MSC **1020** forwards the REGNOT message (2.) to the relevant STPs **1030** as shown in Fig. 10. However, instead of forwarding the REGNOT message (3.) to the SHLR **1040** as shown in Fig. 10, the REGNOT message (3.) in Fig. 11 is forwarded to the common platform including both the MSC **1110** and the I-HLR **1140**. The MSC **1110** and I-HLR **1140** may communicate with one another using any desired proprietary communications protocol, without need to conform to the SS7 signaling protocol at that point. Nevertheless,

the I-HLR **1140** is updated with presence and location information regarding the roaming wireless device **1090**.

In the conventional scenario, presence and location information is restricted to use by the 'home' service provider of a particular wireless device. Using conventional signaling protocols, other wireless networks are not provided with presence and location information regarding wireless devices other than those which subscribe to its services. The presence and location information is conventional used only by the home service provider for routing of call information (e.g., establishing a voice connection to a mobile wireless device).

Accordingly, there is a need for providing presence and location information to entities other than just those servicing a particular wireless device, thus enabling a new host of network services and applications.

SUMMARY OF THE INVENTION

In accordance with the principles of the present invention, a mobile activity status tracker comprises a database relating to individual wireless device subscribers. A communications channel allows entry of data into the database via a signaling transfer point. A TCP/IP communications channel communicates information contained in the database to an external entity over the Internet/Intranet.

A method of providing a database of presence and location information regarding wireless system subscribers in accordance with another aspect of the present invention comprises forwarding a registration notification message from a Home Location Register to a mobile activity status tracker, and transmitting at least one of presence and location information relating to at least one wireless system subscriber to an application server via the Internet/Intranet.

Apparatus for providing a database of presence and location information regarding wireless system subscribers in accordance with yet another aspect of the present invention comprises means for copying and forwarding to a mobile activity status tracker a registration notification message sent to a Home Location Register, and means for transmitting at least one of presence and location information relating to at least one wireless system subscriber to an application server via an Internet/Intranet.

BRIEF DESCRIPTION OF THE DRAWINGS

Features and advantages of the present invention will become apparent to those skilled in the art from the following description with reference to the drawings, in which:

Fig. 1 shows an exemplary architecture and information flow of a mobile activity status tracker (MAST) system, in accordance with the principles of the present invention.

Fig. 2 is a more detailed architecture and information flow of an embodiment of a MAST system corresponding to a stand-alone Home Location Register (SHLR) including a Mobile Registration Trigger (MRT) mechanism utilizing message flows in conformance with SS7 standards and IS-41 standards, in accordance with the principles of the present invention.

Fig. 2A shows a block diagram of the basic elements of an exemplary MAST system shown in Fig. 2.

Fig. 3 is a detailed architecture and information flow of an embodiment of a MAST system corresponding to an integrated Home Location Register (I-HLR) including a Mobile Registration Trigger mechanism integrated with a mobile switching center (MSC) on a common platform, utilizing message flows in conformance with SS7 standards and

IS-41 standards, in accordance with the principles of the present invention.

Fig. 4 is a detailed architecture and information flow of an embodiment of a MAST system corresponding to a stand-alone Home Location Register (SHLR) including a Registration Notification copy function in a signaling transfer point (STP) and a TCP/IP connection (or SS7 connection) to the MAST application, particularly useful in wireless networks having HLRs which do not include a mobile registration trigger (MRT), in accordance with the principles of the present invention.

Fig. 5A is a simplified depiction of relevant parameters of a Mobile Registration Notification (REGNOT) message in conformance with SS7 and IS-41 standards utilized for determination of location information in a MAST system, in accordance with the principles of the present invention.

Fig. 5B is a detailed depiction of all conventional parameters of a REGNOT message.

Fig. 6 is a simplified depiction of relevant parameters of a Mobile Subscriber Inactive message in conformance with SS7 and IS-41 standards utilized for determination of inactive presence information in a MAST system, in accordance with the principles of the present invention.

Fig. 7A is a simplified depiction of relevant parameters such as location in an exemplary Internet Protocol (IP) message sent from the MAST system to an application server (e.g., a Chat Server) via the Internet, in accordance with the principles of the present invention.

Fig. 7B is a simplified depiction of relevant parameters in another exemplary IP message such as a log of past presence and location information for a particular wireless device sent from the MAST system to an application server (e.g., a law enforcement authority) via the Internet, in accordance with the principles of the present invention.

Fig. 8 shows an exemplary Mobile Station Identity (MSID) ordered table, in accordance with the principles of the present invention.

Fig. 9 shows an exemplary process by which the parsed message portions are processed.

Fig. 10 shows a conventional stand-alone Home Location Register (SHLR) architecture and message flow of a Mobile Registration Notification message (REGNOT).

Fig. 11 shows a conventional integrated Home Location Register (I-HLR) architecture and message flow of a Mobile Registration Notification message (REGNOT) allowing proprietary communications between elements such as the MSC and I-HLR operating on a common platform.

DETAILED DESCRIPTION OF ILLUSTRATIVE EMBODIMENTS

The present invention relates to a technique and apparatus to provide status tracking of presence and/or location of a mobile, wireless device to a requesting entity even outside of a particular wireless system. This allows wireless service providers the ability to monitor and log changes in the status of mobile stations within and/or outside their networks enabling the development of multiple applications and network services. Embodiments are disclosed wherein presence and/or location information is provided to entities outside of a particular servicing wireless network using the mechanisms of call processing components of a mobile network (e.g., call setup procedures), and using standard mechanisms currently available to any appropriately conforming Mobile Switching Center (MSC) element.

Mobile presence and location are key concepts for location-based services and applications which require knowledge of mobile station/subscriber availability. Currently, conventional systems do not

provide such wireless intelligent network (WIN) service for wireless devices.

It is important to note that existing systems and techniques have been conventionally located outside of a wireless network. As such, the existing systems have not been privy to, nor had the need to be privy to, triggers needed to obtain true mobile presence or location information.

A disclosed embodiment is a software application package which tracks and reports status and activity of mobile wireless devices in a wireless network using mobile registration message, inactivity message forwarding, and/or mobile automatic notification of subscriber status to TCP/IP entities. This embodiment of a mobile activity status tracker is referred to herein as a Mobile Activity Status Tracker (MAST).

In accordance with the principles of the present invention, status changes that are recorded are sent via TCP/IP communications to other service provider-specific applications. The MAST system duplicates the same or similar information of a corresponding HLR, but is available as an external database entity which functions and communications are not restricted by SS7 standards.

Tracking in accordance with the principles of the present invention utilizes registration/de-registration activity of mobile stations. Utilizing status changes for a particular mobile station, key events can be noted regarding presence and/or location of the particular mobile station.

The MAST application offers entities (e.g., Internet and others) outside of a wireless infrastructure the ability to receive presence and/or location information regarding a particular mobile station to network entities outside of that which is servicing a particular wireless device. As disclosed, the MAST application has the ability to pull presence and/or location information or to push presence and/or location information to a requesting entity as desired.

Certain capabilities such as Mobile Registration Trigger / Registration Notification Forward Message and SMPP client which are basic to this application, are described in detail in two pending U.S. Applications by the same Assignee as the present case. In particular, an exemplary SMSC is described in co-pending and co-owned U.S. Appl. No. 09/322,929, entitled "Short Message Service Notification Between Multiple Short Message Service Centers", filed June 1, 1999, by Timothy J. Lorello and Reuben D. Hart, the entirety of which is explicitly incorporated herein by reference. Moreover, an exemplary Prepaid functionality and architecture is described in co-pending and co-owned U.S. Appl. No. 09/533,805, entitled "Prepaid Call Management In Intelligent Network", filed March 23, 2000, by Elizabeth Countryman, Timothy J. Lorello, Mark Titus, and Dara Ung, the entirety of which is explicitly incorporated herein by reference.

The Mobile Activity Status Tracker (MAST) is a Service Package Application (SPA) that allows wireless service providers to monitor and log changes in the status of mobile stations within their networks. The status changes that are recorded are sent via TCP/IP to other servers for service provider-specific applications. The tracking involves the registration/de-registration activity and location of the mobile stations. The tracking need not track call-specific information, e.g., called telephone numbers or information regarding conversations sustained by the tracked wireless subscribers.

Some disclosed embodiments relate to the use of a Home Location Register (HLR) which is integrated with a Mobile Switching Center (MSC) on a common platform, referred to herein as Integrated Home Location Registers (I-HLRs) commercially available from LUCENT TECHNOLOGIES INC. in Murray Hill, New Jersey. Other embodiments relate to the use of a stand-alone HLR separate from the MSC platform,

referred to herein as Stand alone HLR's (S-HLR). All types of HLRs are collectively referred to herein as an HLR.

The disclosed MAST SPA is implemented on an Advantage Service Control Point (SCP) Wireless Intelligent Network Platform, commercially available from LUCENT TECHNOLOGIES INC. The SCP provides the required ANSI SS7 and TCP/IP protocol support and Service Circuit Handlers (SCH) for the MAST SPA.

In accordance with the principles of the present invention, the MAST SPA receives mobile activity notifications from an HLR, and forwards selected parameters upon request or configuration to servers external to the wireless network over a TCP/IP communication link (e.g., over the Internet or over an Intranet).

Fig. 1 shows an exemplary architecture and information flow of a mobile activity status tracker (MAST) system, in accordance with the principles of the present invention.

In particular, as shown in Fig. 1, the operation of the exemplary MAST SPA includes the following exemplary steps:

(1) The handset exchanges activity information with the I-HLR, which in turn sends the Mobile Station Identity (MSID) of the mobile station and a set of relevant parameters to the MAST SPA in an (MRT) message.

(2) The MAST SPA creates a temporary record for that mobile handset based on the MSID. The MAST performs a lookup in a database of existing records, using the MSID as a key. If there is no record for the MSID, then the temporary record is stored in the database. If there is a record for the same MSID, the MAST compares the temporary record with that found in the database to determine any changes in the activity status of the mobile station (or any other relevant parameters). If the activity status is the same (i.e., unchanged), the MAST overwrites the old record with the new one. On the other hand, if the activity status has

changed, the activity status of the relevant mobile wireless device will be Notified or Forwarded to one or more application servers having access to the Internet using an appropriate TCP/IP interface and appropriate IP addresses (or other suitable protocol and communication path, e.g., SS7). To this end, the MAST SPA will forward a set of selected parameters (e.g., a subset of the parameters available in the temporary record) to one or more requesting or pre-configured applications servers using corresponding Internet Protocol (IP) addresses. The MAST then replaces the existing, older record with the new, updated record.

Preferably, the MAST resides on an SCP and accepts copies of IS-41 Registration Notification and MSInactive messages from the HLR(s).

Fig. 2 is a more detailed architecture and information flow of an embodiment of a MAST system **200** corresponding to a stand-alone Home Location Register (SHLR) **240** including a Mobile Registration Trigger (MRT) mechanism utilizing message flows in conformance with SS7 standards and IS-41 standards, in accordance with the principles of the present invention.

In particular, Fig. 2 shows a MAST system **200** implemented by a particular service provider corresponding to a first wireless network **260**. The first wireless network **260** also includes an MSC **1010**, and a SHLR **240**.

A second wireless network **1070** is shown for completeness and perspective. The second wireless network **1070** includes an MSC **1020**, and services a wireless device **1090**.

The MAST **200** provides presence and/or location information regarding any or all subscriber's of the first wireless network to external entities, without the need to change current communication standards, e.g., utilizing otherwise conventional SS7 and IS-41 communication messages.

The MAST **200** includes information similar to that contained in the SHLR, e.g., relating to the presence and/or location of serviced wireless devices. However, in accordance with the principles of the present invention, the MAST **200** may include additional information, and/or logged information over time with respect to each individual subscriber. The MAST **200** may be implemented on a same type platform as that implementing the SHLR **240**, e.g., an SCP commercially available from LUCENT TECHNOLOGIES INC.

Fig. 2A shows a block diagram of the basic elements of an exemplary MAST system **200** shown in Fig. 2.

Importantly, the MAST **200** includes a TCP/IP interface **270** and internal module **201** allowing appropriate operational access to subscriber presence and/or location information maintained therein. Thus, any or all external application servers **290** (e.g., chat servers, law enforcement servers, etc.) may access subscriber presence and or location information regarding a wireless service provider's subscribers via the Internet **280**.

The subscriber's presence and/or location information maintained in a subscriber presence/location database **205** may be pre-configured for transmission to various pre-set application servers **290** via the TCP/IP (i.e., non-SS7 protocol) module **201** and associated link **270**. Alternatively, presence and/or location information regarding any or all subscriber's serviced by the MAST **200** may be provided to an application server **290** upon request by the application server **290**.

Referring back to Fig. 2, the particular applications which can be implemented by the various application servers **290** is virtually limitless. Any application which can make use of the presence and/or location information regarding any or all wireless subscribers (regardless of whether or not they are inside or external to a particular wireless

network) may utilize the information contained in the database of the MAST **200** in accordance with the principles of the present invention.

The message flow shown in Fig. 2 relates to that of a stand-alone HLR **240**. The message flow utilizing an integrated HLR is shown in Fig. 3. The message flow in Fig. 2 is as follows.

A MOBILE REGISTRATION message (1.) is transmitted by a relevant wireless device **1090** through the host wireless network #2 **1070** to its MSC **1020**. That MSC **1020** sends a MOBILE REGISTRATION NOTIFICATION (REGNOT) message (2.) to an STP **1030**, which forwards a REGNOT message (3.) to the SHLR **240**. Up to this point the message flow is as in the conventional system shown in Fig. 10.

However, as shown in Fig. 2, the SHLR **240** implements a message referred to herein as a MOBILE REGISTRATION TRIGGER (4. in Fig. 2). The MOBILE REGISTRATION TRIGGER (4.) forwards a received REGNOT message (3.) back out to the STP **230** as a REGNOT message (5.), destined for the MAST **200**.

The STP **230** forwards the REGNOT message (5.) from the SHLR to the MAST **200** using a REGNOT message (6.). Thus, the SHLR **240** shown in Fig. 2 is an otherwise conventional SHLR, but additionally includes the functions necessary to implement a Mobile Registration Trigger (MRT) to forward the REGNOT message (5.) to the MAST system **200** via the STP **230** using another forwarded REGNOT message (6.). With the architecture of the embodiment of Fig. 2, a service provider may need to upgrade software running on an associated SHLR **240**, but need not upgrade their MSC **1010** or STP **230** from those otherwise conventionally available or already installed, providing significant cost savings and efficiency.

In response to the REGNOT message (6.) received from the STP **1030**, the MAST **200** updates its database **205** appropriately. The

information contained in the database **205** is then made available as appropriate over the TCP/IP link **270** to an external device, e.g., using an Intranet or the Internet **280**, e.g., to all requesters, to only some requesters paying a particular fee for such a service, etc.

The service provider **250** is given operational and maintenance access to the MAST **200** similarly to conventional access given to an SHLR, e.g., using an X.25, RS-232 or TCP/IP link.

Fig. 3 is a detailed architecture and information flow of an embodiment of a MAST system **200** corresponding to an integrated Home Location Register (I-HLR) including a Mobile Registration Trigger mechanism integrated with a mobile switching center (MSC) on a common platform, utilizing message flows in conformance with SS7 standards and IS-41 standards, in accordance with the principles of the present invention.

In particular, Fig. 3 shows that when using an I-HLR **340**, the communications between the MSC/I-HLR common platform and the STP **330** are typically made over an SS7 link to the common platform, and that the elements on the common platform (e.g., the MSC **310** and the I-HLR **340**) may communicate with one another in proprietary ways without the need to conform to SS7 or other external signaling requirements.

The I-HLR **340** shown in Fig. 3 is an otherwise conventional I-HLR, but additionally includes the functions necessary to implement a Mobile Registration Trigger (MRT) to forward the REGNOT message (5.) to the MAST system **200** via the STP **230** using another forwarded REGNOT message (6.). With the architecture of the embodiment of Fig. 3, a service provider may need to upgrade software running on an associated I-HLR **340**, but need not upgrade their MSC **310** or STP **330** from those otherwise conventionally available or already installed.

Fig. 4 is a detailed architecture and information flow of an embodiment of a MAST system corresponding to a stand-alone Home

Location Register (SHLR) including a Registration Notification copy function in a signaling transfer point (STP) and a TCP/IP connection (or SS7 connection) to the MAST application, particularly useful in wireless networks having HLRs which do not include a mobile registration trigger (MRT), in accordance with the principles of the present invention.

In particular, Fig. 4 importantly shows an STP **430** including otherwise conventional functions, but in addition includes a REGNOT copy and forward function.

The REGNOT copy and forward function in the STP **430** copies the REGNOT message (2.) received from an MSC **1020**, and forwards a REGNOT copy message (3b.) to the MAST **200**. The STP **430** also sends the otherwise conventional REGNOT message (3.) to the SHLR **1040**.

The STP **430** shown in Fig. 4 is an otherwise conventional STP, but additionally includes the functions necessary to implement a COPY and FORWARD message to generate a copy of the REGNOT message (3.) sent to the SHLR **1040** as a copy REGNOT message (3b.) sent to the MAST **200**. With the architecture of the embodiment of Fig. 4, a service provider may need to upgrade software running on an associated STP **430**, but need not upgrade their MSC(s) **1010** or SHLR(s) **1040** from those otherwise conventionally available or already installed.

The MAST system architecture shown in Fig. 4 has the advantage of eliminating some communications (e.g., the MRT trigger (4.) and the REGNOT message (5.) shown in Fig. 3), which is particularly important because the MRT trigger (4.) is an enhanced proprietary feature (i.e., not standard) to some HLRs.

The service may be provided in a provisionless mode, and all the necessary subscriber information may reside on the HLR. Thus, there is preferably no specific subscriber provisioning necessary on the MAST SPA. Rather, the subscriber data may be maintained at the

relevant HLR. The amount of memory, e.g., random access memory (RAM) and the number of SS7 links required by the SCP platform implementing the MAST SPA may be determined based on the subscriber count to be supported.

For instance, as a general guideline, consider the following example. Assuming a load of 500,000 subscribers, one (1) Message Registration Trigger (MRT) per subscriber per hour, five (5) Mobile Inactivity Triggers (MITs) per subscriber per day, 1 KB of memory per subscriber, and an average SS7 message length of 100 octects, the number of SS7 links required in the disclosed embodiment for this configuration is approximately four (4), along with approximately 500 MB of RAM.

Use of Signaling Transfer Points (STPs) between MSCs can be implemented in multiple I-HLR environments as well.

From the perspective of a wireless service provider, MAST allows the implementation of an endless array of services and/or applications that can utilize presence and/or location information regarding a wireless device. Specific implementations of services will depend on the capabilities of the application servers that receive the information from the MAST. For instance, knowledge of registration activity in and of itself represents a huge benefit for the service provider from a marketing perspective because it can provide additional information regarding subscriber's habits, and general demographic data collection.

The MAST techniques and apparatus may also be used for law enforcement purposes. For instance, data relating to mobile station activity may be used, e.g., as evidence to build a legal case against an offender.

As another benefit, subscribers of a wireless service provider can be provided with an enhanced protection mechanism against

fraud by allowing faster detection and/or tracking of delinquent mobile devices.

Depending upon particular parameters used, other services may be implemented. For instance, with knowledge of the location of a particular mobile station, a wireless service provider may implement an "Emergency Location" plan. Using such a service, mobile subscribers can have activity information (e.g., presence and/or location information, together with date and time) relating to the use of their mobile device transmitted to the MAST SPA in accordance with the principles of the present invention. The MAST SPA will log the presence and/or location information regarding relevant mobile subscribers served by the associated HRL, and pass the logged information on to any entity on the Internet or other entity or network, providing an accurate and up-to-date information source. Using the "Emergency Location" plan, the logged location information may be used by authorities to locate a person associated with that particular mobile device easier.

Fig. 5A is a simplified depiction of relevant parameters of a Mobile Registration Notification (REGNOT) message in conformance with SS7 and IS-41 standards utilized for determination of location information in a MAST system, in accordance with the principles of the present invention. Fig. 5B is a detailed depiction of all conventional parameters of a REGNOT message.

In particular, the REGNOT message parameters utilized by the MAST may be any or all parameters included or inferred from information within the standard REGNOT message shown in Fig. 5B. For instance, the cell site ID **502** and/or sector ID **504** of the cell servicing the relevant wireless device may be used to provide a location of the wireless device, and date and time of a communication may be used for presence information.

Other information such as power level **506** can be used to infer and further refine the location information. For instance, a lower power level received by the wireless device **1090** (and/or higher power output by the wireless device **1090**) may be used to infer a longer distance from the relevant cell site receiving transmissions from the wireless device **1090**. Conversely, a lower power level might infer that the wireless device **1090** is closer to the cell site. Thus, a sort of 'poor man's GPS' can be provided to external entities regarding the location of a subscriber's wireless device.

Fig. 6 is a simplified depiction of relevant parameters of a Mobile Subscriber Inactive message in conformance with SS7 and IS-41 standards utilized for determination of inactive presence information in a MAST system, in accordance with the principles of the present invention.

In particular, a MOBILE SUBSCRIBER INACTIVE message follows the same paths as does the REGNOT messages shown in Figs.2, 3 and 4. While the REGNOT message indicates an active wireless device, the receipt of a MOBILE SUBSRIBER INACTIVE message with respect to a particular subscriber may be logged in the database **205** of the MAST **200** as presence information, i.e., that the wireless device may no longer be present.

Fig. 7A is a simplified depiction of relevant parameters such as location in an exemplary Internet Protocol (IP) message sent from the MAST system to an application server (e.g., a Chat Server) via the Internet, in accordance with the principles of the present invention.

The particular information contained either in the database **205** of the MAST and/or which is transmitted over the TCP/IP connection **270** and the Internet **280** may depend upon the particular applications operating on any of the application servers **290**. Rudimentary information may include, e.g., an IP address of the application server **290**, an ID of the relevant mobile wireless device, presence information such as a date

and time of activity, and location information either real or inferred. Real information may include the cell site ID and/or sector ID. Inferred or extrapolated information may include, e.g., a delta distance corresponding to a power level of the wireless device's transmitter during a last contact.

Fig. 7B is a simplified depiction of relevant parameters in another exemplary IP message such as a log of past presence and location information for a particular wireless device sent from the MAST system to an application server (e.g., a law enforcement authority) via the Internet, in accordance with the principles of the present invention.

For instance, as shown in Fig. 7B, presence and/or location information may be logged into a historical file for each subscriber/wireless device. A particular mobile ID together with a series of database entries corresponding to different REGNOT commands and/or MOBILE SUBSCRIBER INACTIVE messages received by the MAST can be provided to one or more particular application servers desiring such information.

Alternatively, the presence and/or location information transmitted to a desiring application server **190** may relate to a group of subscribers having a common attribute (e.g., most active subscribers, least active subscribers, subscribers living in a particular region, etc.).

As disclosed, activity status information is tracked by the MAST as follows. Initially, the MAST receives a Mobile Registration message via a Mobile Registration Trigger (MRT), alternatively referred to as a Registration Forward Message, from the relevant MSC/HLR (I-HLR or S-HLR), and appropriately updates the activity status in the database. Upon power down of the relevant wireless device, the MAST will receive a Mobile De-Registration message via a Mobile Inactive Trigger (MIT) from the relevant MSC/HLR, and appropriately updates the activity status in the database.

When a new message (e.g., a mobile registration message or mobile de-registration message) is received, the MAST application preferably parses the message, e.g., into up to 10 parameters, and stores the parsed message portions in an appropriate MSID ordered table.

Fig. 8 shows an exemplary Mobile Station Identity (MSID) ordered table is shown in Fig. 8.

Fig. 9 shows an exemplary process by which the parsed message portions are processed.

In particular, as shown in step **202** of Fig. 9, the process determines if a new REGNOT or MSINACT has been received.

If a record for the same MSID is found in the table of Fig. 8, in step **204** a comparison of the status and key parameters within the two records will be made.

In step **208**, if the status (ACT to DEACT or DEACT TO ACT) or one of the key parameters are different from that of the previous record, a subset of key parameters up to and including all key parameters from this new record will be sent to at least one, but possibly multiple IP addresses on a network.

In steps **206** and **210**, the old record is replaced in the MSID table with the new, most recent record.

The MAST receives information directly from the HLR or the STP (e.g., I-HLR or S-HLR), which has previously validated the MSID and determined the need to forward the information to the MAST.

Administration of the MAST may include, e.g., configuration and maintenance of the following:

- Point-codes and Subsystem numbers of the I-HLRs that will send information to the MAST SPA.
- Parameters that the I-HLR will forward to the MAST SPA in the MRT and MIT messages.

- Parameters that the MAST SPA will forward to the application servers.
- Destination IP addresses and Port numbers of the application servers.
- Expiration time for records that have not experienced changes over a configurable period of time.
- Size of the rotating log file.

There is preferably only one record per MSID in the MAST. The relevant service provider is preferably given access to the database stored in the MAST, e.g., through the conventional operational maintenance processor (OMP).

Due to its nature, the content of this database is likely to change rapidly over time, therefore the MAST database may provide only a snapshot of the activity status of all the relevant wireless devices at any given time.

The MAST preferably keeps a temporary log of the messages sent to the application services in a rotating file. This rotating file may have a configurably fixed size, and may overwrite itself with more recent information, e.g., after a desired period of time determined by the level of message traffic. This log provides a historical representation of the activity of specific wireless devices, or groups of wireless devices.

Reports may be generated for the relevant service provider, e.g., through the OMP or via a TCP/IP connection to the Internet. Possible reports can include, e.g., various information depending upon the parameters that the relevant HLR sends to the MAST, and/or specific needs and selections made by the particular service provider.

In case the subscriber base increases, the platform can be easily scaled to increase capacity.

Being a Wireless Intelligent Network service, MAST takes advantage of the improved reliability, scalability and performance of the Advantage Platform and the flexibility of the intelligent network approach.

Additionally, MAST is an Intelligent Network application that can be executed simultaneously on a single SCP platform, such as a Short Message Service Center, Over The Air Activation, PrePaid Wireless, etc. This fact spreads the cost of the platform over several services, thus allowing the service provider to price them in a competitive way. From an operating standpoint, a single platform is easier to manage resulting in reduced maintenance costs.

While the invention has been described with reference to the exemplary embodiments thereof, those skilled in the art will be able to make various modifications to the described embodiments of the invention without departing from the true spirit and scope of the invention.

CLAIMS

What is claimed is:

1. A mobile activity status tracker, comprising:

a database relating to individual wireless device subscribers;

a communications channel to allow entry of data into said database via a signaling transfer point; and

a TCP/IP communications channel for communicating information contained in said database to an external entity over at least one of an Internet and an Intranet.

2. The mobile activity status tracker according to claim 1, wherein:

said communications channel utilizes a TCP/IP communications protocol.

3. The mobile activity status tracker according to claim 1, wherein:

said communications channel utilizes a Signaling System #7 communications protocol.

4. The mobile activity status tracker according to claim 3, wherein:

said communications channel conforms to an IS-41 standard.

5. The mobile activity status tracker according to claim 1, wherein:

said data entered into said database is previously forwarded by a Home Location Register.

6. The mobile activity status tracker according to claim 5, wherein:

said Home Location Register is a stand-alone Home Location Register.

7. The mobile activity status tracker according to claim 6, wherein:

said Home Location Register is integrated with a message servicing center on a common platform.

8. The mobile activity status tracker according to claim 1, wherein:

said mobile activity status tracker is external to a Home Location Register servicing said individual wireless device subscribers

9. The mobile activity status tracker according to claim 8, wherein:

said mobile activity status tracker communicates with said Home Location Register servicing said individual wireless device subscribers using a Signaling System #7 protocol.

10. The mobile activity status tracker according to claim 9, wherein:

said mobile activity status tracker communicates with said Home Location Register servicing said individual wireless device subscribers using an IS-41 protocol.

11. The mobile activity status tracker according to claim 1, wherein:

said mobile activity status tracker is adapted to compare a temporary record with entries in said database to determine any changes in activity status relating to a relevant wireless device and overwrite an existing record with said temporary record if a change in activity status is determined.

12. The mobile activity status tracker according to claim 11, wherein:

said mobile activity status tracker is further adapted to forward relevant information relating to said determined changes in activity status to at least one relevant application server.

13. A method of providing a database of presence or location information regarding wireless system subscribers, comprising:

forwarding a registration notification message from a Home Location Register to a mobile activity status tracker; and

transmitting at least one of presence and location information relating to at least one wireless system subscriber to an application server via at least one of an Internet and an Intranet.

14. The method of providing a database of presence and location information regarding wireless system subscribers according to claim 13, further comprising:

comparing a temporary record with entries in said database to determine any changes in activity status relating to a relevant wireless device; and

overwriting an existing record with said temporary record if a change in activity status is determined.

15. The method of providing a database of presence and location information regarding wireless system subscribers according to claim 14, wherein:

said registration notification message is forwarded through a signaling transfer point between said Home Location Register and said mobile activity status tracker.

16. The method of providing a database of presence and location information regarding wireless system subscribers according to claim 14, wherein:

said registration notification message is signaling system #7 and IS-41 compliant.

17. The method of providing a database of presence and location information regarding wireless system subscribers according to claim 16, wherein:

said registration notification message is IS-41 compliant.

18. The method of providing a database of presence and location information regarding wireless system subscribers according to claim 14, wherein:

said Home Location Register is a stand-alone Home Location Register.

19. Apparatus for providing a database of presence and location information regarding wireless system subscribers, comprising:

means for forwarding a registration notification message from a Home Location Register to a mobile activity status tracker; and

means for transmitting at least one of presence and location information relating to at least one wireless system subscriber to an application server via at least one of an Internet and an Intranet.

20. The apparatus for providing a database of presence and location information regarding wireless system subscribers according to claim 19, further comprising:

means for comparing a temporary record with entries in said database to determine any changes in activity status relating to a relevant wireless device; and

means for overwriting an existing record with said temporary record if a change in activity status is determined.

21. The apparatus for providing a database of presence and location information regarding wireless system subscribers according to claim 20, wherein:

said means for forwarding forwards said registration notification message through a signaling transfer point between said Home Location Register and said mobile activity status tracker.

22. The apparatus for providing a database of presence and location information regarding wireless system subscribers according to claim 20, wherein:

said registration notification message is signaling system #7 compliant.

23. The apparatus for providing a database of presence and location information regarding wireless system subscribers according to claim 22, wherein:

said registration notification message is IS-41 compliant.

24. The apparatus for providing a database of presence and location information regarding wireless system subscribers according to claim 20, wherein:

said Home Location Register is a stand-alone Home Location Register.

25. Apparatus for providing a database of presence and location information regarding wireless system subscribers, comprising:

means for copying and forwarding to a mobile activity status tracker a registration notification message sent to a Home Location Register; and

means for transmitting at least one of presence and location information relating to at least one wireless system subscriber to an application server via at least one of an Internet and an Intranet.

26. The apparatus for providing a database of presence and location information regarding wireless system subscribers according to claim 25, further comprising:

means for comparing a temporary record with entries in said database to determine any changes in activity status relating to a relevant wireless device; and

means for overwriting an existing record with said temporary record if a change in activity status is determined.

27. The apparatus for providing a database of presence and location information regarding wireless system subscribers according to claim 26, wherein:

said means for copying and forwarding sends said copied registration notification message over a TCP/IP connection to said mobile activity status tracker.

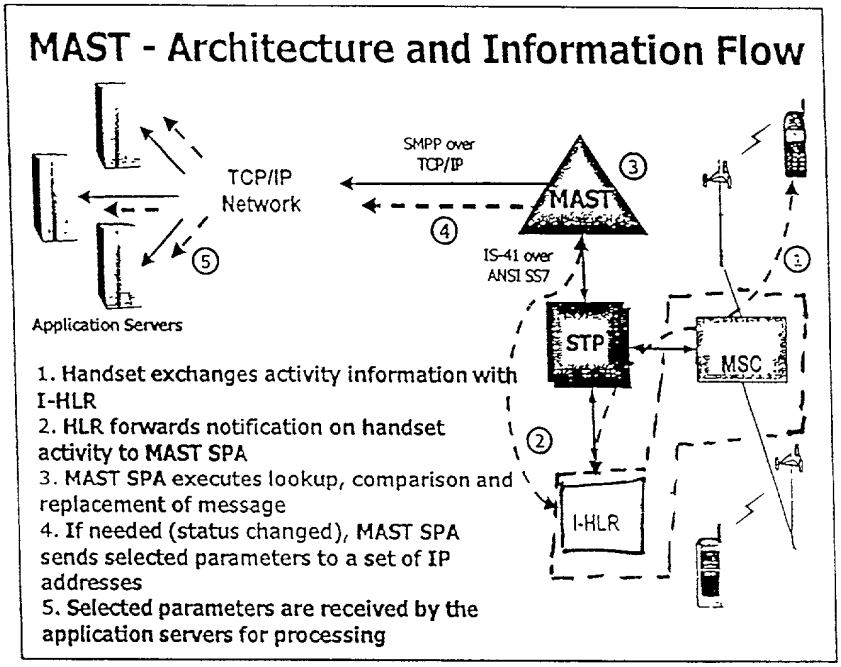
28. The apparatus for providing a database of presence and location information regarding wireless system subscribers according to claim 26, wherein:

said registration notification message is sent to said Home Location Register using signaling system #7 protocol; and

said means for copying and forwarding sends said copied registration notification message over a TCP/IP connection to said mobile activity status tracker.

ABSTRACT

A technique and apparatus to provide status tracking of presence and/or location of a mobile, wireless device to a requesting entity even outside of a particular wireless system. This allows wireless service providers the ability to monitor and log changes in the status of mobile stations within and/or outside their networks. Embodiments are disclosed wherein presence and/or location information is provided to entities outside of a particular servicing wireless network using the mechanisms of call processing components of a mobile network (e.g., call setup procedures), and using standard mechanisms currently available to any appropriately conforming Mobile Switching Center (MSC) element. A mobile activity status tracker (MAST) is disclosed which contains a database of information similar to the information contained in the Home Location Register. The MAST tracks and reports status and activity of mobile wireless devices in a wireless network using mobile registration message, mobile inactivity message forwarding, and/or mobile automatic notification of subscriber status to TCP/IP entities (e.g., application servers on the Internet or Intranet). The MAST system duplicates the same or similar information contained in a corresponding HLR, but is available as an external database entity which is not restricted by SS7 standards. The tracking need not track call-specific information, e.g., called telephone numbers or information regarding conversations sustained by the tracked wireless subscribers.



MAST Architecture and Information Flow

Fig. 1

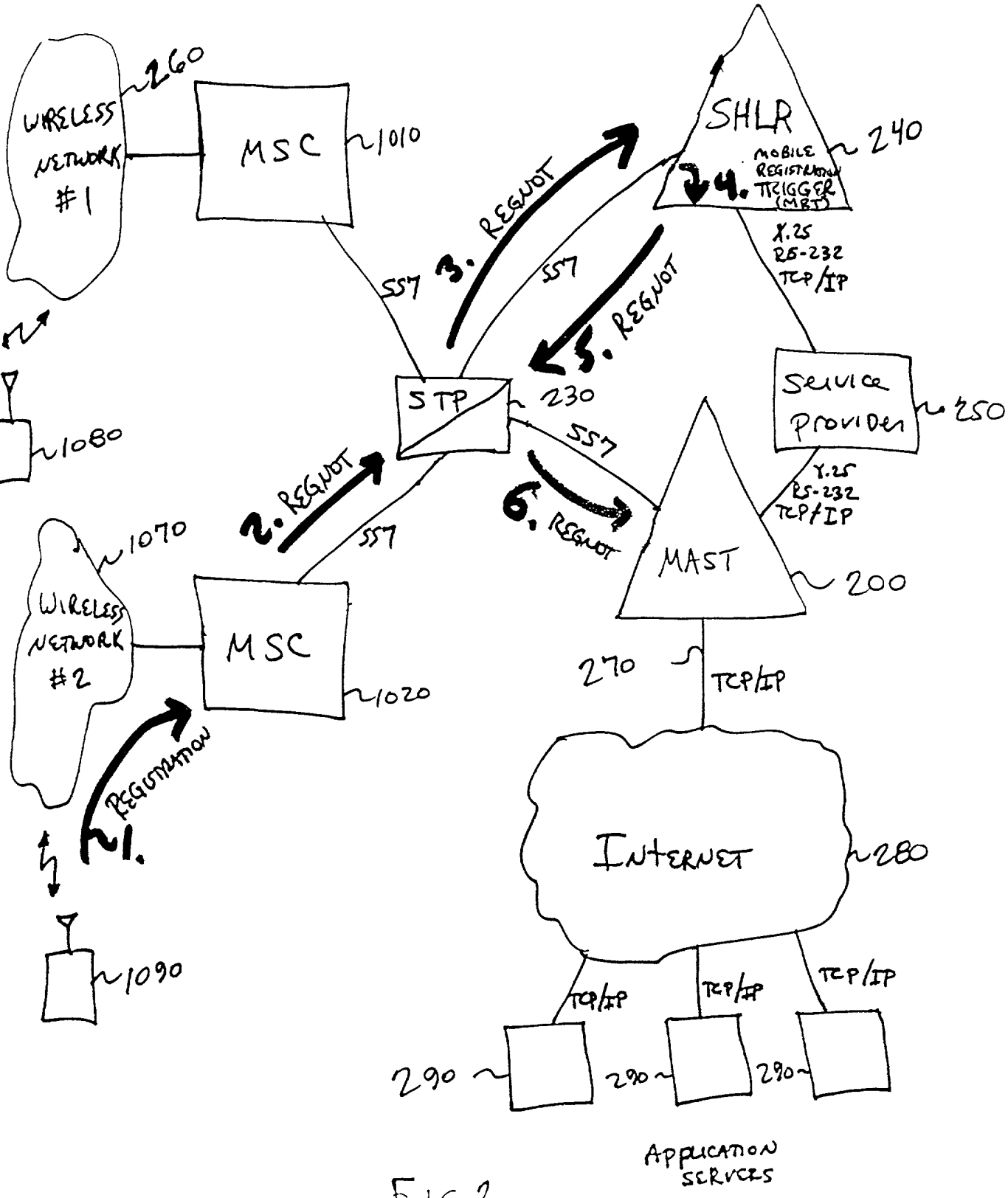

WIRELESS NETWORK #1
260
MSC
1010
SHLR
240
MOBILE REGISTRATION TRIGGER (MRT)
4.
X.25 RS-232 TCP/IP
SS7
3. REGNOT
SS7
5. REGNOT
STP
230
Service Provider
250
1080
SS7
2. REGNOT
6. REGNOT
X.25 RS-232 TCP/IP
1070
WIRELESS NETWORK #2
MSC
1020
MAST
200
270
TCP/IP
REGISTRATION
1.
INTERNET
280
TCP/IP
TCP/IP
TCP/IP
1090
290
290
290
APPLICATION SERVERS

FIG. 2

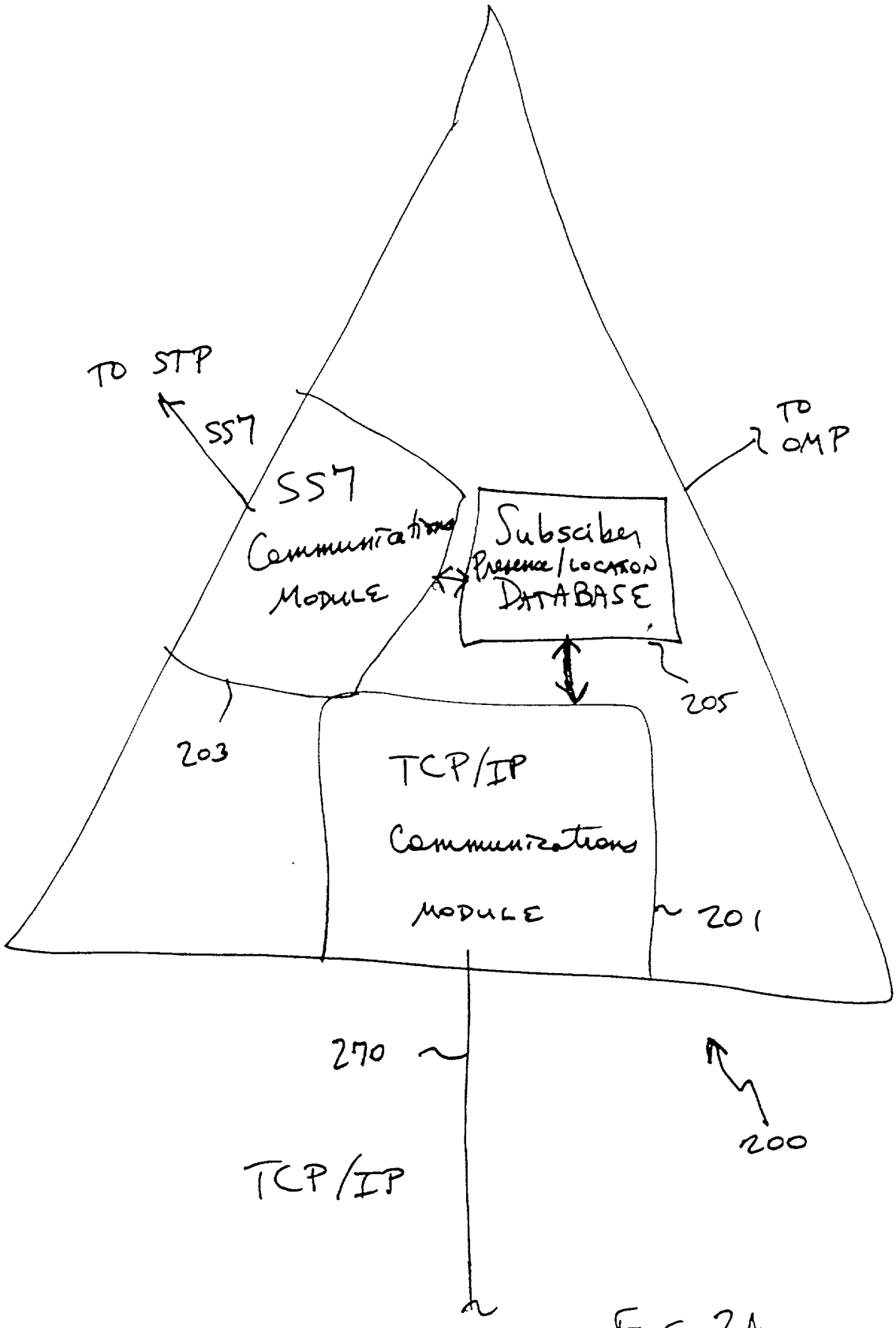

TO STP
SS7
SS7 Communications Module
Subscriber Presence/Location DATABASE
TO OMP
205
203
TCP/IP Communications Module
201
270
200
TCP/IP

FIG. 2A

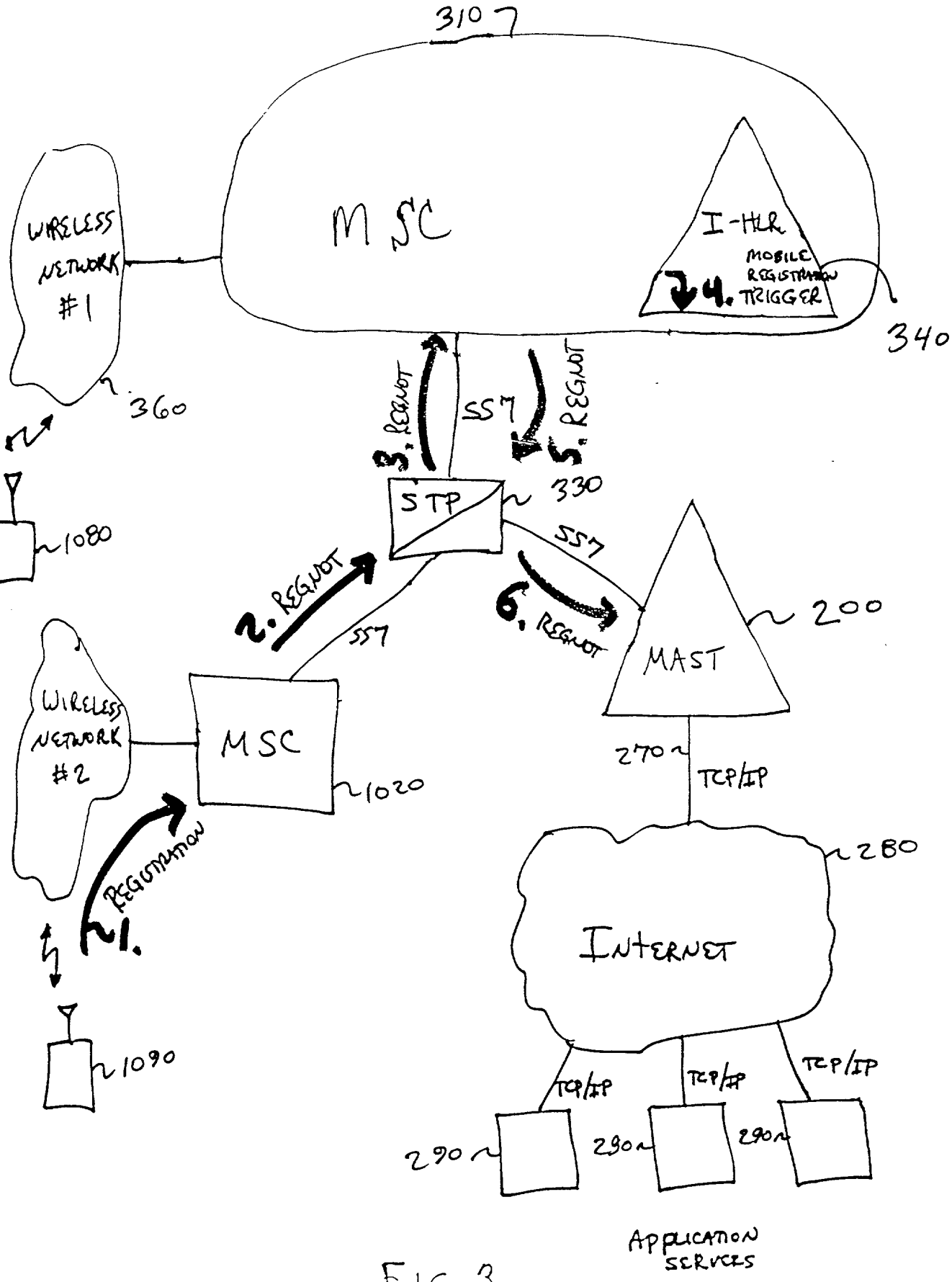

3107
MSC
WIRELESS NETWORK #1
360
I-HLR
MOBILE REGISTRATION TRIGGER
4.
340
3. REGNOT
SS7
5. REGNOT
STP
330
1080
SS7
2. REGNOT
SS7
6. REGNOT
MAST
200
WIRELESS NETWORK #2
MSC
1020
270
TCP/IP
REGISTRATION
1.
INTERNET
280
1090
TCP/IP
TCP/IP
TCP/IP
290
290
290
APPLICATION SERVICES

FIG. 3

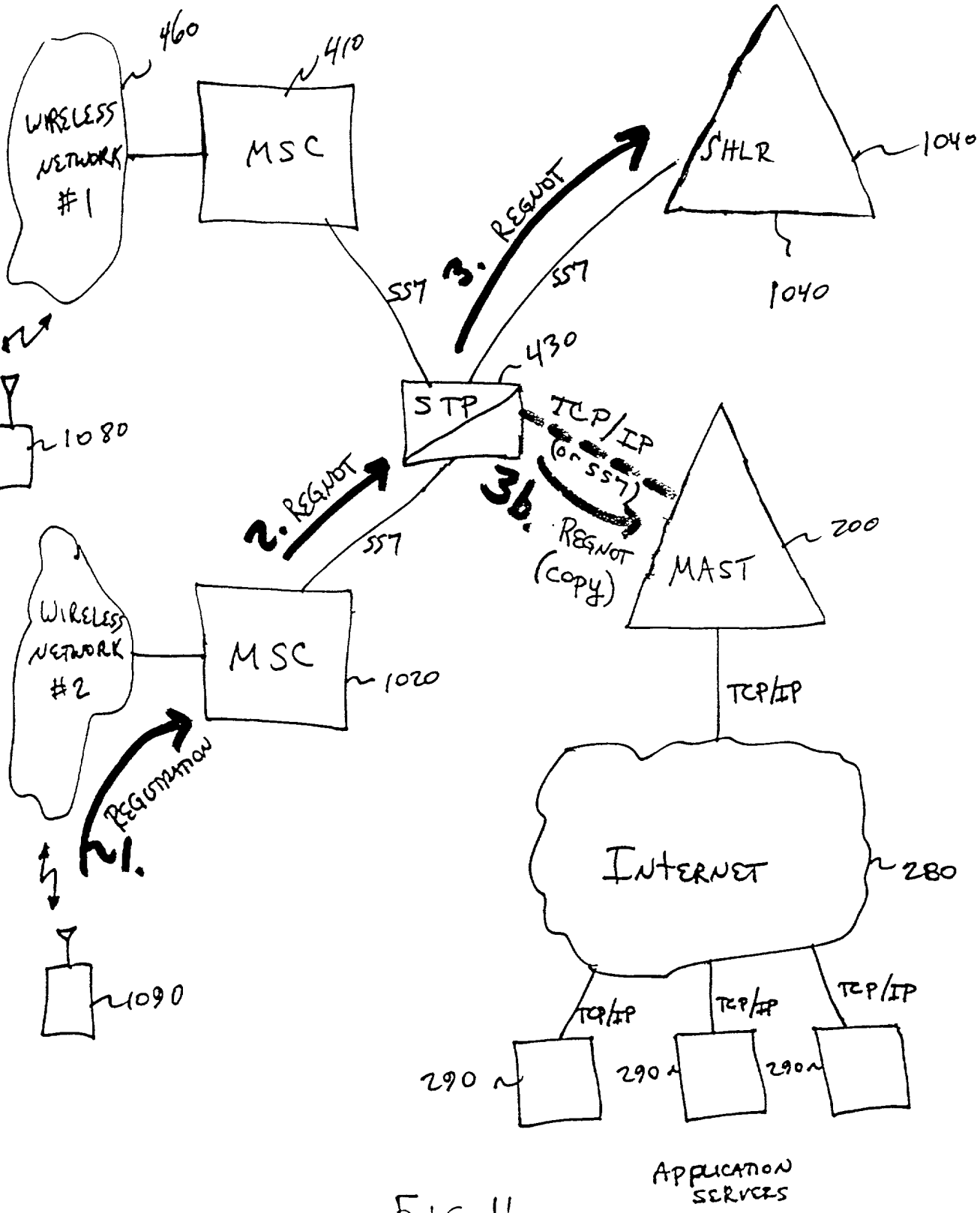

460
410
WIRELESS NETWORK #1
MSC
SS7
3. REGNOT
SS7
SHLR
1040
1040
1080
STP
430
TCP/IP (or SS7)
2. REGNOT
SS7
3b. REGNOT (COPY)
MAST
200
WIRELESS NETWORK #2
MSC
1020
TCP/IP
REGISTRATION
1.
INTERNET
280
TCP/IP
TCP/IP
TCP/IP
290
290
290
APPLICATION SERVERS
1090

FIG. 4

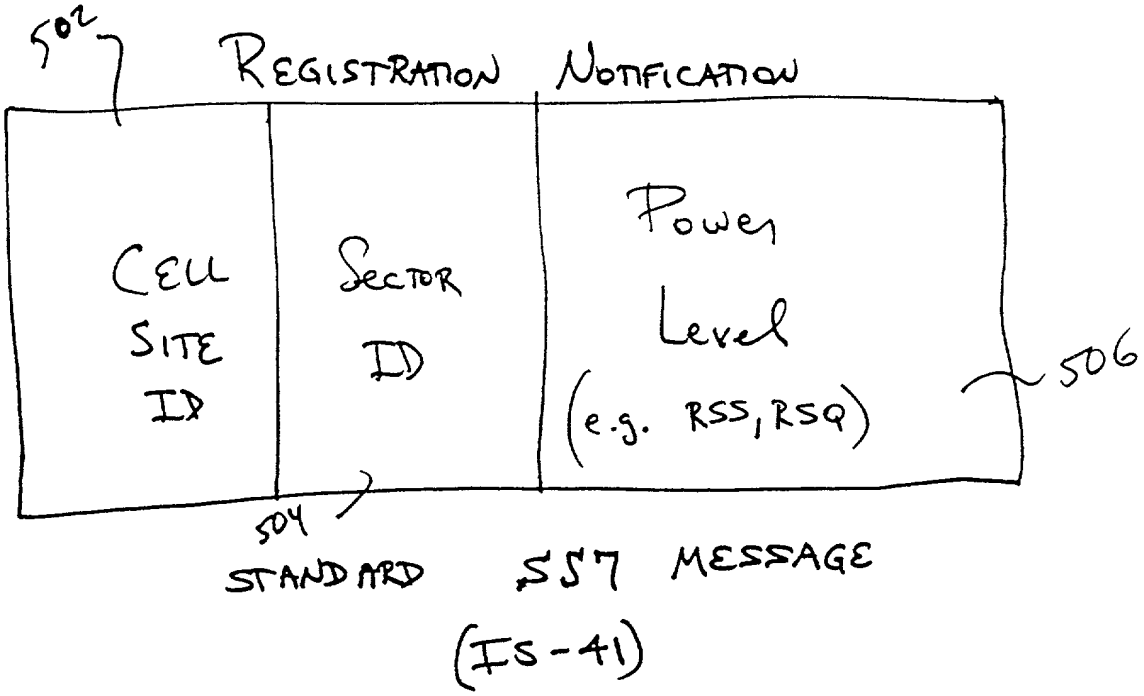

502
REGISTRATION NOTIFICATION
CELL SITE ID
SECTOR ID
POWER LEVEL (e.g. RSS, RSQ)
506
504
STANDARD 557 MESSAGE
(IS-41)

FIG. 5A

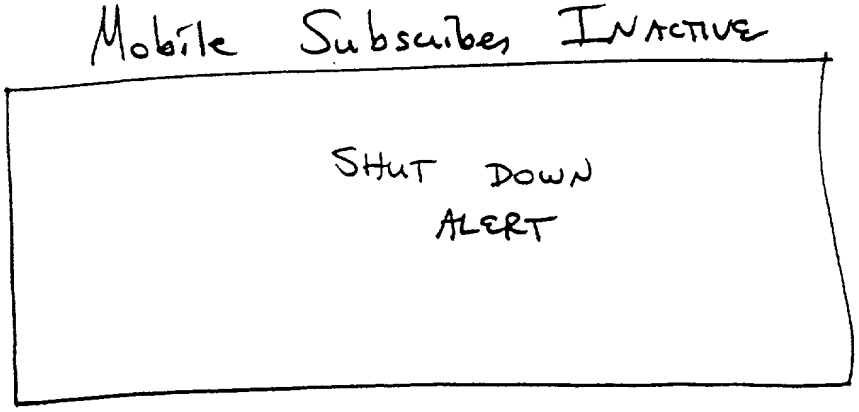
RegistrationNotification INVOKE Parameters	
Field	**Value**
Identifier	SET [NATIONAL 18]
Length	variable octets
Contents	
ElectronicSerialNumber	
MobileIdentificationNumber	
MSCID (Serving MSC)	
QualificationInformationCode	
SystemMyTypeCode (Serving MSC or VLR)	
AvailabilityType	
BorderCellAccess	
ControlChannelData	
ExtendedMSCID (VLR)	
LocationAreaID	
PC_SSN (Serving MSC or VLR)	
ReceivedSignalQuality	
ReportType	
SenderIdentificationNumber	
SMS_Address	
SMS_MessageWaitingIndicator	
SystemAccessData	
SystemAccessType	
SystemCapabilities	
TerminalType	
TransactionCapability	

RegistrationNotification INVOKE Parameters

PRIOR ART

FIG. 5B

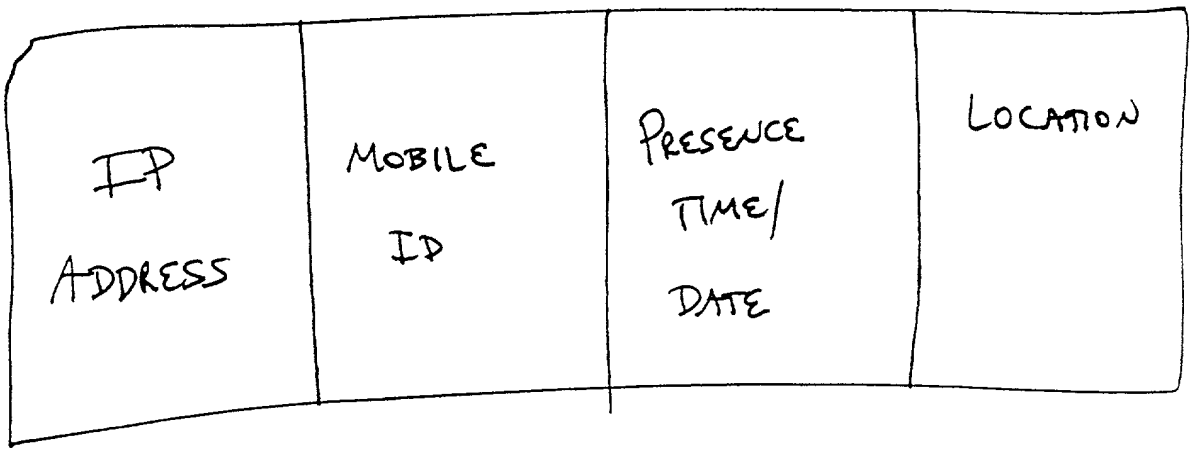
Document Page 2 of 3



STANDARD SS7 MESSAGE
(IS-41)

FIG. 6

09/23/2003 22:09:56



IP MESSAGE TO APPLICATION SERVER (e.g., to Chat Server)

FIG. 7A

IP ADDRESS	MOBILE ID	LOG	PRESENCE TIME/DATE	LOCATION
		#1		
		#2		
		#3		
		#4		
		#5		
		#6		

IP MESSAGE TO APPLICATION SERVER

FIG. 7B

SAMPLE OF TABLE

MSID	ACTIVE Y/N	LAST DATE/TIME	PARAMETER 1	PARAMETER 2	PARAMETER 3
COMPARE FIELD	Y	N	Y	N	Y
SEND FIELD	Y	Y	Y	Y	Y
9083067462	Y	120314520000	XX	YY	ZZ

FIG. 8

SAMPLE DECISION TREE

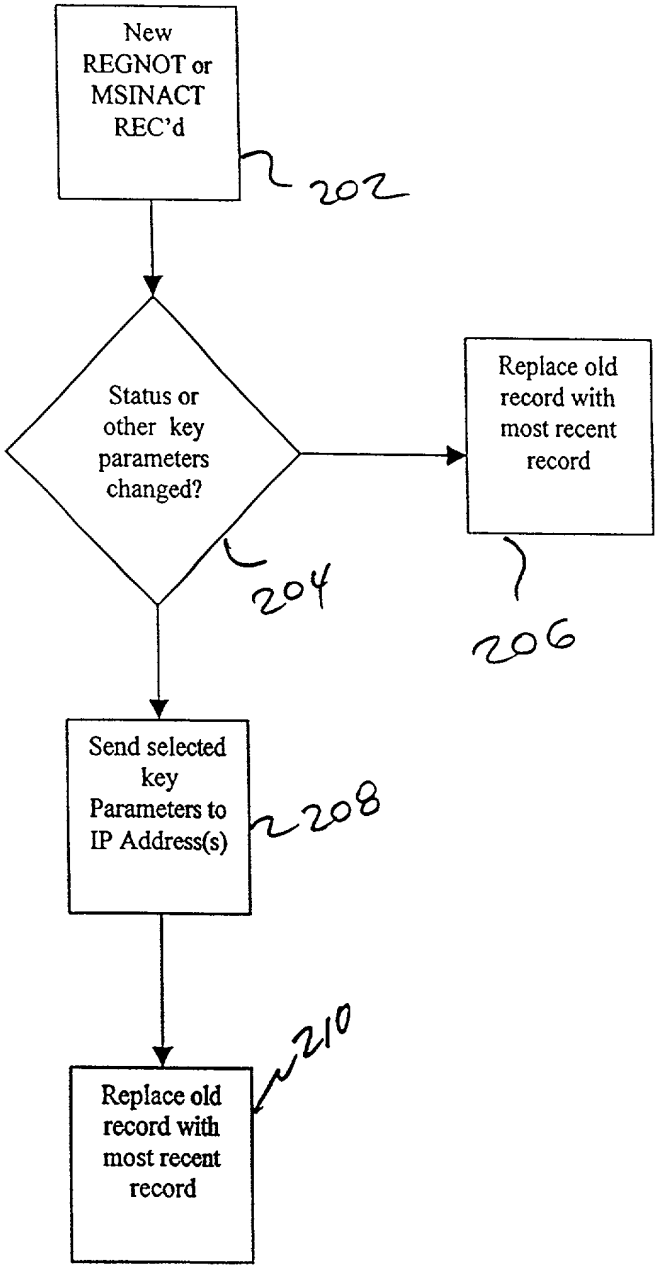


FIG. 9

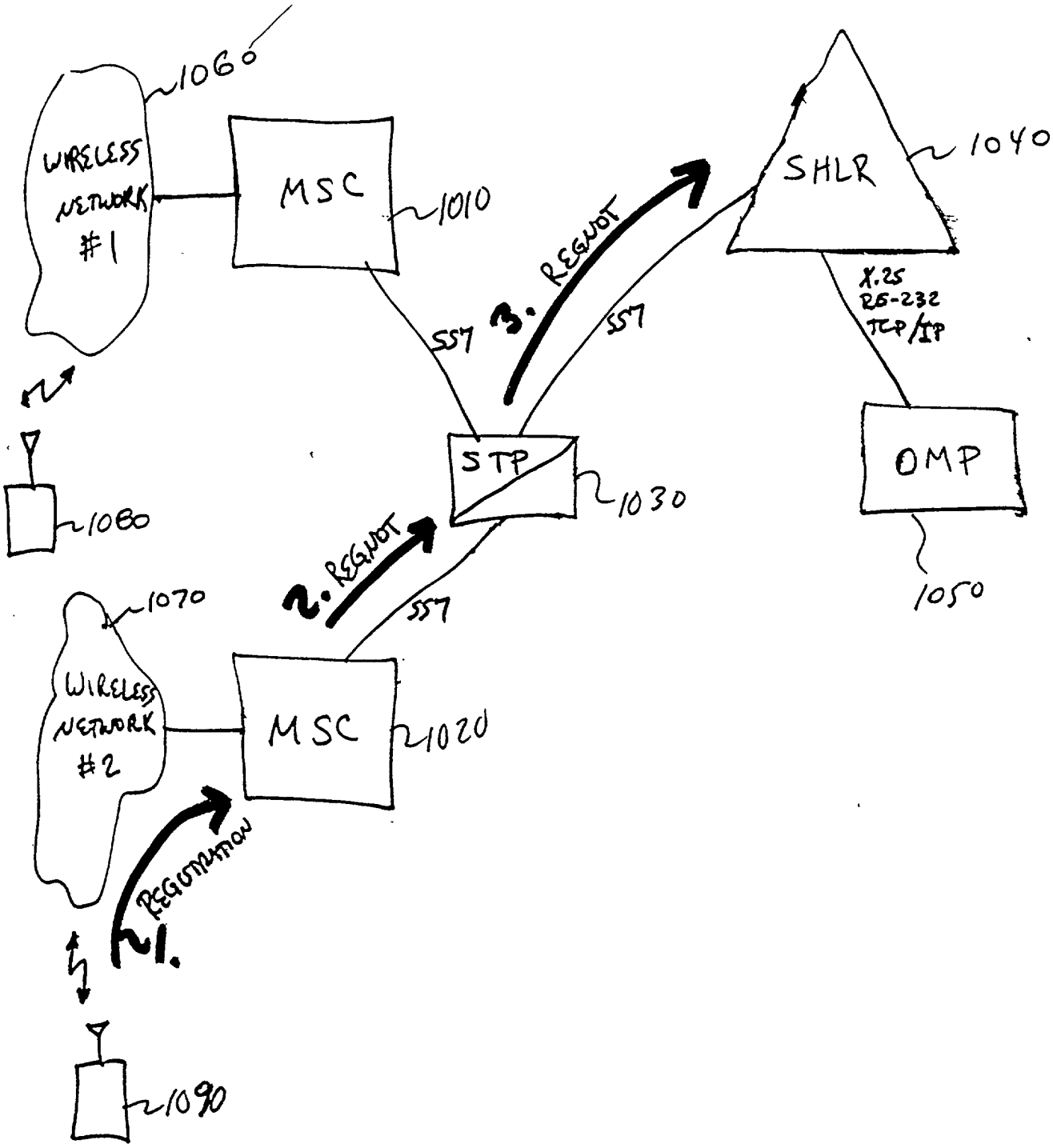

1060
WIRELESS NETWORK #1
MSC
1010
SS7
3. REGNOT
SS7
SHLR
1040
X.25
RS-232
TCP/IP
OMP
1050
STP
1030
1080
2. REGNOT
SS7
1070
WIRELESS NETWORK #2
MSC
1020
REGISTRATION
1.
1090

FIG. 10

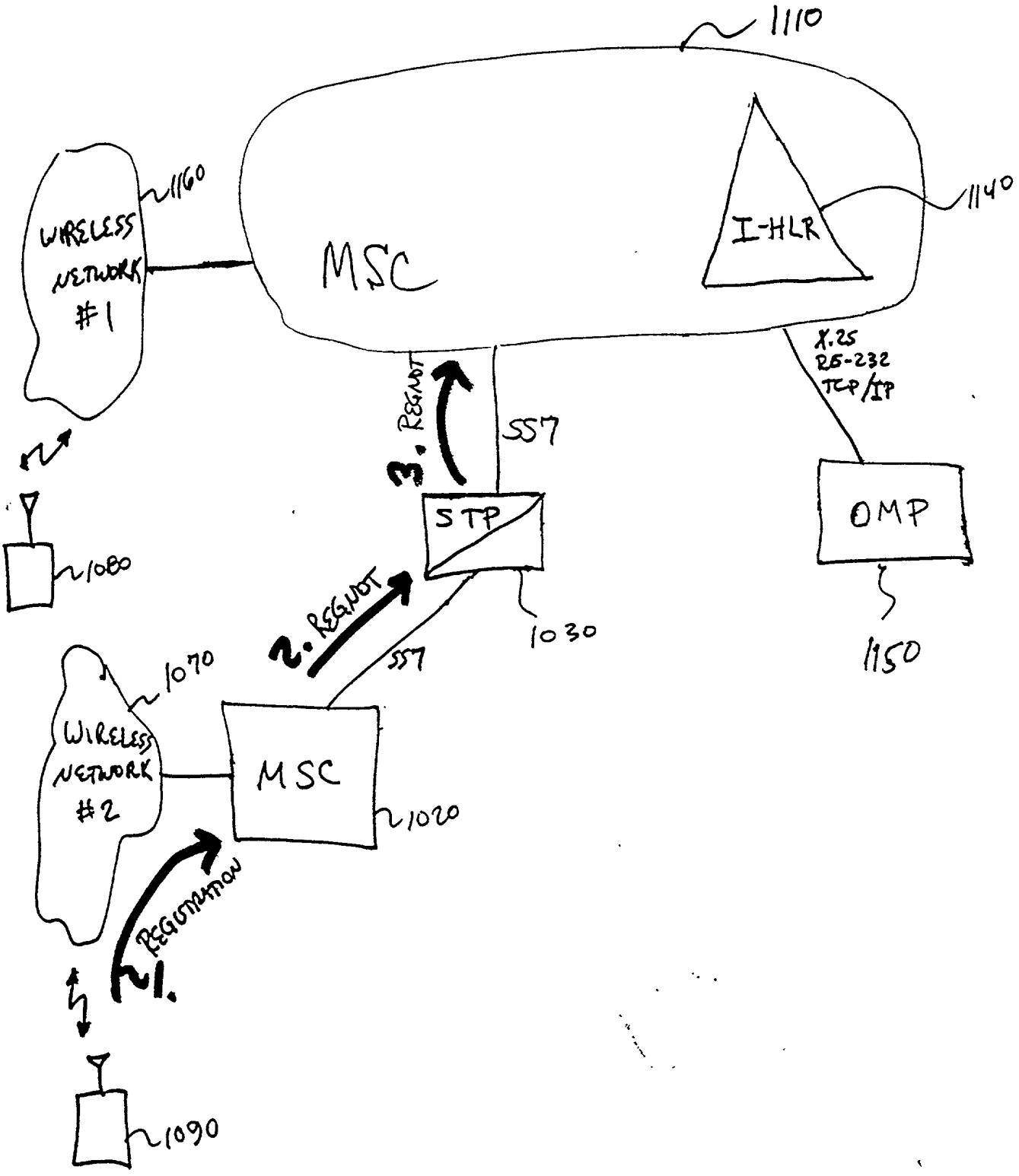

1110
MSC
I-HLR
1140
WIRELESS NETWORK #1
1160
X.25
RS-232
TCP/IP
3. REGNOT
557
STP
OMP
1080
2. REGNOT
1030
1150
557
1070
WIRELESS NETWORK #2
MSC
1020
REGISTRATION
1.
1090

FIG. 11

20-430

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Declaration and Power of Attorney

As below named inventors, we hereby declare that:

Our residence, post office address and citizenship are as stated below next to our names.

We believe we are the original, first and joint inventors of the subject matter which is claimed and for which a patent is sought on the invention entitled **MOBILE ACTIVITY STATUS TRACKER**, the specification of which is filed herewith.

We hereby state that we have reviewed and understand the contents of the above-identified specification, including the claims, as amended by an amendment, if any, specifically referred to in this oath or declaration.

We acknowledge the duty to disclose all information known to us which is material to patentability as defined in Title 37, Code of Federal Regulations, 1.56.

We hereby claim foreign priority benefits under Title 35, United States Code, 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

None

We hereby claim the benefit under Title 35, United States Code, 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, 112, We acknowledge the duty to disclose all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application:

Provisional Application No. 60/196,104, filed April 11, 2000

We hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

We hereby appoint the following attorneys with full power of substitution and revocation, to prosecute said application, to make alterations and amendments therein, to receive the patent, and to transact all business in the Patent and Trademark Office connected therewith:

William H. Bollman	(Reg. No. 36,457)
Edward J. Stemberger	(Reg. No. 36,017)
Jeffrey S. Melcher	(Reg. No. 35,950)
W. Warren Taltavull	(Reg. No. 25,647)

Please address all correspondence to **FARKAS & MANELLI PLLC, 2000 M Street, N.W. Suite 700, Washington, DC 20036-3307**, and all telephone calls to **William H. Bollman** at **(202) 261-1020.**

Full name of 1st inventor: **Erik L. WALLACE**

Inventor's signature _____ Date: 5/10/2000
Residence: **Annapolis, Anne Arundel County**
Citizenship: **USA**
Post Office Address: **1326 Swan Drive, Annapolis, Maryland 21401**

Full name of 2nd inventor: **Walter WEICHSELBAUMER**

Inventor's signature _____ Date: 5/15/2000
Residence: **Annapolis, Anne Arundel County, Maryland**
Citizenship: **VENEZUELA**
Post Office Address: **1020 Spa Road, Annapolis, Maryland 21403**

Full name of 3rd inventor: **Daniel J. HRONEK**

Inventor's signature _____ Date: 5/10/2000
Residence: **Annapolis, Anne Arundel County, Maryland**
Citizenship: **USA**
Post Office Address: **1709 Woodlore Road, Annapolis, Maryland 21401**

Full name of 4th inventor: **Mark TITUS**

Inventor's signature _____ Date: 5/11/00
Residence: **Arnold, Anne Arundel County, Maryland**
Citizenship: **USA**
Post Office Address: **396 Kiltie Court, Arnold, Maryland 21012**

Full name of 5th inventor: **Dara UNG**

Inventor's signature _____ Date: 5/10/2000
Residence: **Odenton, Anne Arundel County, Maryland**
Citizenship: **CANADA**
Post Office Address: **843 Snow Valley Lane, Odenton, Maryland 21113**

DOCKET # 20-430